Critical Problem with 'Smart' Meters

One the most basics aspects in the reliability of electrical installation is the protection contra lightning surge This is due to the critical threats that can occur how no adequate surge protection. (Electronic meters that contain electronic components are also named "smart," AMR, ERT, AMI, digital opt-out, digital radio-off, Power Line Carrier (PLC) and more).

The NEC set as value of Grounding Resistance, a maximum of 25 Ohms. Due to the high values of resistivity's that are found, it is not possible in many cases to reach this standard. The ignorance on the part of the personnel that designs and builds these grounding systems, does not allow an optimal result. Many times, a simple electrode is not enough and the available space is very small, thus requiring the use of low resistivity's (lrm) materials to achieve this standard. In many cases, is necessary to make a grounding systems named groundbeds.

An additional problem arises because in homes there are not only grounding systems for electrical applications, but also other types of buried electrodes for telephony, TV and other applications. In this situation, it is necessary the ***bonding*** of these systems in order to avoid a ground potential rise.

A very important aspect is the measurement of the resistivity of the ground, (Wenner's method), without which there is no possibility of making a correct calculation of the grounding systems.

The power surges of electrical utilities, connection or disconnection maneuvers, such as inductive and capacitive loads, can be transmitted the way the Smart meters and the importance to have a Surge Protective Devices to drain the energy to ground. Otherwise, the same meter and equipment may be subject to catastrophic damage and a danger to human beings.

Two class of device are known: Filters and TVSS.

The filter are used to cut high frequency, blocking these and allowing the passage of industrial frequencies.

Transient Voltage Surge Suppressor (TVSS), Surge Protection Devices (SPD) or Surge Suppression Equipment (SSE) is the equipment designed to protect electrical and electronic equipments from power surges and voltage spikes.

COMPONENTS

-**A MOV (Metal Oxide Varistor)** is also known as voltage-dependent resistor (VDR). A varistor withstands significantly increased current when high voltage is applied between its terminals. This remains non-conductive as a shunt-mode device during normal operation when the voltage across it remains well below its clamping voltage, thus varistors are typically used for suppressing line voltage surges.

-**Gas Discharge Tube (GDT)**
-**Silicon Avalanche Diode (SAD)**
-**The combination** of resistors, capacitors and/or inductors.

The need arises to install a good grounding systems. If the latter is not effective, nor will the best device protect against damage and accidents.

The threats inherent in second generation smart meters are, among other things, electromagnetic wave emissions called dirty electricity,(EMC) which is classified in FCC into two classes of devices, called class A and class B. This last classification corresponds to the Smart meters. This type of radiant energy affects human beings in one way or another. In addition to its RF transmitter, each wireless digital meter also has a component called the 'switching-mode power supply' (SMPS) – switching power supply for short. (This is for the functioning of the meters).

In this way, we have solutions proposed for the latter, such as Faraday Cage type coatings, which will produce attenuation of electromagnetic emissions. A fundamental part of Smart meters is that they do not have a grounding connection as is specified at the beginning.

The Smart Meter Cover is built of a steel mesh which is made of stainless steel and this must be of high quality. The mesh acts like a Faraday Cage and absorbs the harmful EMF radiation coming from Smart Meters. This is bonding to earth with the cover of the smart meter.
It is very important to achieve a characterization of the soil by the electrical utilities, and to design and build the Grounding System according to the average resistivity and even more importantly, measure the Re once the construction process is finished.

DESIGN OF A GOOD GROUNDING SYSTEM

Equations used frequently for design in grounding systems. (Low frequency)

(Lowing Re)

Rod without treatment

(1) H.B Dwight:

$$\frac{\rho}{2*\pi*L}*\left(\ln\left(4*\frac{L}{r}\right)-1\right)$$

Where L, is the rod length, r is the radio, and ρ is the resistivity of the soil.

(2) R. Rudenberg

$$\frac{\rho}{2*\pi*L}*\ln\left(2*\frac{L}{r}\right)$$

Rods with conductive concrete.

(3) Fagan-Lee

$$\frac{1}{2.\pi.L}*\left[\rho.\left(\ln\left(\frac{8.L}{2.r1}\right)-1\right)+\rho1.\left(\ln\left(\frac{8.L}{2.r}\right)-1\right)-\rho1.\left(\ln\left(\frac{8.L}{2.r1}\right)-1\right)\right]$$

Where L is the length of the rod, ρ the resistivity of the natural soil, ρ1 is the resistivity of the material, r is the radius of the rod and r1 is the radius of the material. In the case of Celec® conductive concrete, the resistivity of the material is 4.8 Ohm-cm, declared value under the standard IEC 62561-7.

ADVANTAGES

If we do the exercise with
ρ1=0.048 Ω-m,
ρ=100 Ω-m,
L=3 m,
r=0.008 m,
r1=0.152 m

We have these results respectively:
(1) R=33, 49 Ω
(2) R=35, 12 Ω
(3) R=22, 19 Ω
(With Irm)

The reduction factor is: R=22, 19/33, 49=0,6625 equivalent to 33,74%, for vertical rods

It should be noted that the above equations describe a calculation of Re in steady state. In transient phenomena, the behavior involves soil ionization phenomena and the impedance is non-linearity, diminishing the impedance of the electrode.

For this, it is necessary not to have coils or sharp curves in the grounding wires, since they produce reflective waves losing their electrode efficiency. We have a induced voltage that is equal to L(di/dt).Figures 1.0 and 2.0

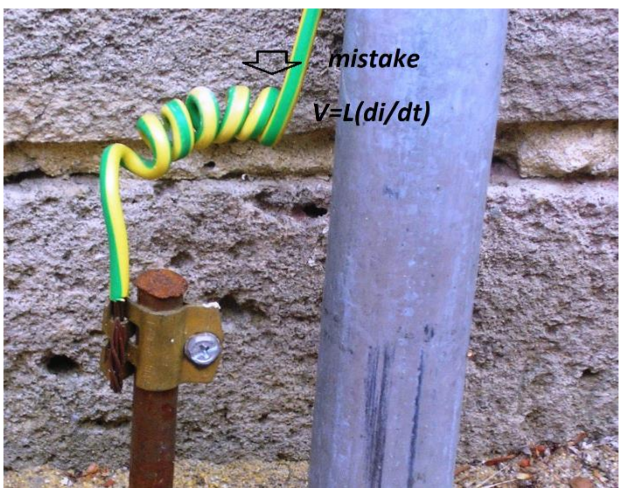

Figure 1.0


Figure 2.0

Ufer electrodes

This method uses the structural steel of the constructions and has been regulated in the NEC since 1969. Because the lightning energy presents a very rapid increase in the temperature of the concrete, the occlusion phenomenon can occur, where the water from the concrete evaporates.

As noted, a good transient suppressor with an efficient grounding systems is totally necessary for the care not only of the Smart meters but also of the user's loads and avoid possible damages that may be caused. Thus, electrical utilities will avoid large claims for accidents, damages and even fires.

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